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Irrigation Management of Alfalfa Seed

Alfalfa is adapted to a wide diversity of soil and climatic conditions in Canada. It is particularly well-adapted to deep, well-drained and near neutral soils. Alfalfa does not grow well in strongly acid soils and the application of lime is often necessary for successful culture. Alfalfa tolerance to soil salinity tends to be poor at germination and the seedling stage of growth, but is moderate (5-10 mS/cm) when the crop becomes established (second year's growth). Alfalfa has very little tolerance for poor drainage conditions. Poor drainage combined with extremes in climate or the presence of plant diseases will adversely affect the survival of the stand. Owing to the varying climatic conditions that occur in the prairies, irrigation farmers are advised to select only the varieties of alfalfa that are recommended for their area and to use the proper inoculant.

The most common method of pollination is through use of the leafcutter bee. Because of the high value of both the seed crop and leaf cutter bees, a large proportion of Canada's alfalfa seed production is on irrigated land.

Irrigation should be scheduled before the bloom stage to maximize flowering, but should be restricted during flowering and then continued for seed filling if required. Depending upon the status of spring moisture, the second year's growth generally requires no irrigation until the bees are taken off the crop. Third and subsequent years should be irrigated as required. The potential for seed production is greatest in the southern prairie region where the high daytime temperatures allow maximum flying time for the alfalfa leafcutter bee. The bees fly at temperatures between 20° and 30°C.

Optimum temperatures for growth of alfalfa are 15 to 25°C during the daytime and 10 to 20°C at night; growth is restricted above 30°C.

Crop water requirements and crop yield

Alfalfa crops develop roots of up to 2.0 m (6.6 ft). The seeding date for alfalfa crops is during early spring. The growth period for established stands is the frost free period.

Seasonal water use by the crop can be as high as 500 mm (20 in.). The daily rate of crop water use is less for alfalfa seed production than for hay production (figure 1). With soil moisture levels sufficient to maximize seed production, highest water use occurs in mid-June and reaches about 5 mm/day (0.2 in. per day). In comparison, for maximum hay production, peak water use of 7.5 mm/day (0.30 in./day) occurs in July.

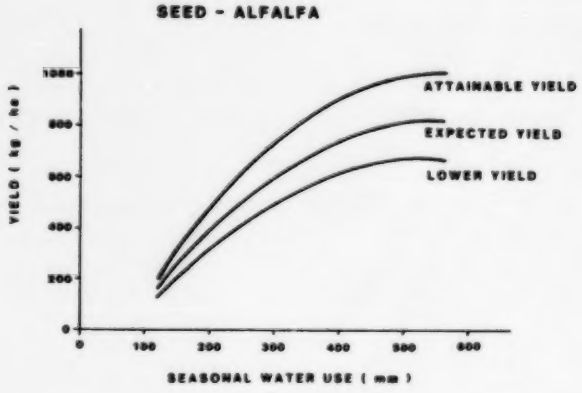
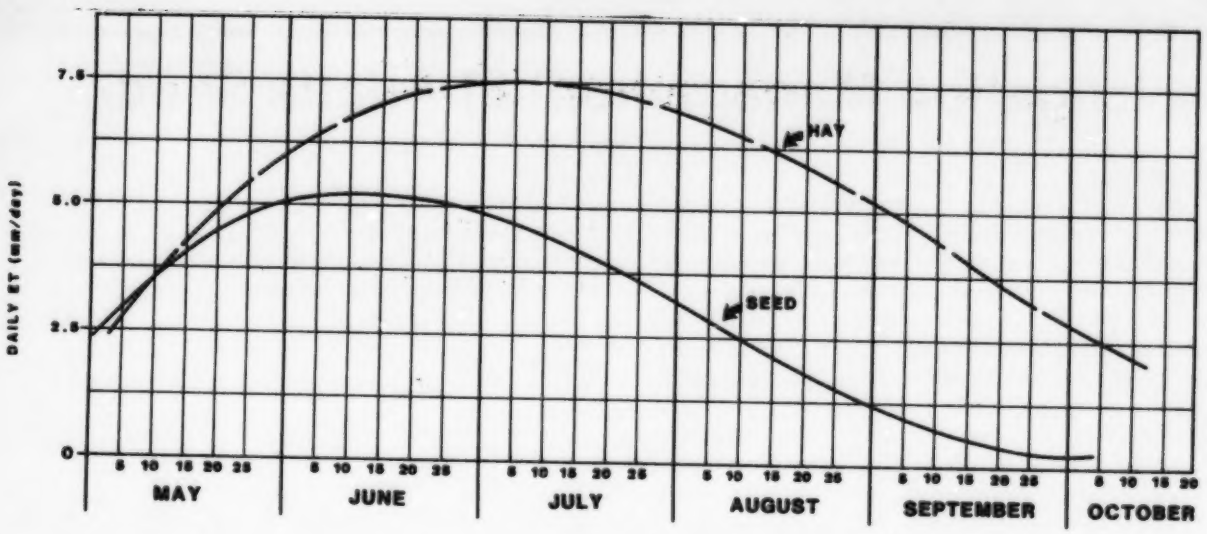


Figure 1.

About 30 per cent of the total water used by the alfalfa seed crop may be available as stored soil water each spring, but the remaining 70-75 per cent must come from rain or irrigation. Rainfall alone is rarely sufficient, so irrigation is almost always needed. When possible fall irrigation after harvest will assure a good supply of stored soil moisture for the next spring. About 70 per cent of water requirements come from the top half of the root zone.

The crop requires ample soil moisture for the entire root zone (maximum of 50 per cent depletion) until late June. This will ensure good healthy growth and early bloom. After this date, moisture depletion to the 75 per cent level in the top half of the root zone is needed to encourage flowers to open up and discourage excessive vegetative growth. Moisture depletion greater than the 75 per cent allowed in the top half of the root zone will reduce seed set and development. A final irrigation the first week in August will provide sufficient moisture for seed set and green growth for protecting the seed from wind damage. This irrigation will also help to replenish deep moisture (wind shattering) reserves for next year's use.

Copies of this and related publications may be obtained from the Print Media Branch, Alberta Agriculture, 7000 - 113 Street, Edmonton T6H 5T6 or Alberta Agriculture's District Offices.



DAILY EVAPOTRANSPIRATION FOR ALFALFA HAY & SEED

Figure 2.

If it is necessary to irrigate while bees are active, care should be taken to protect the hives by earthen dykes so as to prevent excess surface water from chilling the hives. Increased humidity may also encourage the growth of mold spores on and in the bee cells in the hives.

The seed crop is ready to harvest when about three-fourths of the seed pods have turned brown or black. Harvest of alfalfa seed occurs generally from late September to early October. On irrigated land, seed yields of 550 to 900 kg/ha (500-800 lb/ac) are attained by good growers, but usually farm yields tend to be in the neighborhood of 400 kg/ha (350 lb/ac).

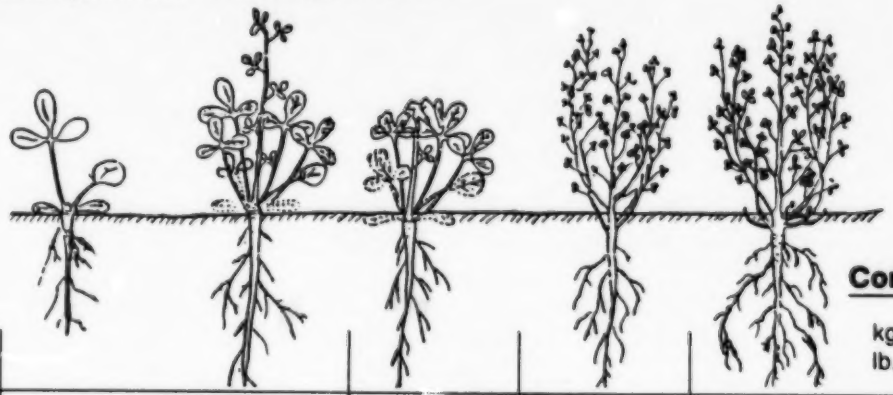
Strategy:

1. Maintain good soil moisture conditions for the entire root zone until bloom stage (not greater than 50 per cent depletion). Irrigations should be frequent and light in application (50 mm).
2. At the bloom stage, allow soil moisture to deplete to 75 per cent in the top half metre of root zone and 50 per cent for the remaining root zone. By putting stress on the crop, flowers open and this encourages bees to pollinate the flowers. By limiting irrigation at this time, the flying time of bees is increased which leads to a potential increase in yield. If moisture depletion exceeds the above guidelines, an irrigation should take place to ensure the crop is not overstressed.
3. A final irrigation during seed formation encourages green growth and reduces the potential for wind shattering.

Irrigation management information

For further information regarding irrigation management of seed alfalfa, contact your nearest irrigation branch office. Locations of these offices are: Lethbridge, 381-5136; Vauxhall, 654-2161; Airdrie, 948-8511; Taber, 223-7908; Strathmore, 934-3356; Brooks, 362-1212; Bow Island, 545-2231; Medicine Hat, 529-3616. North of Calgary, contact the Airdrie office or your local district agriculturist for assistance.

Growth and development of alfalfa seed production



Conversion factor

kg/ha = 0.89 lb/ac
lb/ac = 1.12 kg/ha

GROWTH PERIODS	VEGETATIVE	CROWN DEVELOPMENT	1st YEAR	SUBSEQUENT YEARS
POST EMERGENCE DATES	40 - 50 DAYS	100 - 120 DAYS	140 - 150 DAYS	
MOISTURE SENSITIVE PERIOD	EARLY SPRING GROWTH TO EARLY BLOOM STAGE			
CROP WATER USE	1.0mm/DAY INITIALLY TO 5.0mm/DAY AT THE BUD STAGE			
CROP ROOTING DEPTH	MAXIMUM DEPTH OCCURS AFTER THE 1st YEAR'S GROWTH			

The above amounts, depths and times are only average values for this particular crop. These values will change depending on the variety and area where this crop is grown.

Soil

Soils can vary greatly in texture from being very fine (clay) to very coarse (sand) within a crop root zone. Because soil texture can change quite quickly so can the amount of water that the soil is able to hold.

Texture	Available Moisture
Loamy sand	8-12 mm/0.1m (0.9-1.4 in./ft)
Sand loam	10-15 mm/0.1m (1.2-1.8 in./ft)
Loam	14-18 mm/0.1m (1.7-2.1 in./ft)
Sand clay loam, clay loam, clay	15-20 mm/0.1m (1.8-2.4 in./ft)
Silty clay loam, silt loam	16-22 mm/0.1m (1.9-2.6 in./ft)

It is important to know and to be able to calculate the amount of moisture present in the soil root zone in order to understand the amount of moisture available for crop use. Allowable depletion level is the amount of soil moisture that can safely be removed from the root zone by a crop before an irrigation is required. For alfalfa seed, the allowable depletion level has been determined to be 50%. The simplest way to determine soil moisture content is by the "feel" method. By feeling, squeezing and observing a handful of soil. The following chart outlines the various characteristics of soil based on different contents of water.

		Feel or Appearance of Soils		
	PERCENT OF AVAILABLE MOISTURE REMAINING	MODERATELY COARSE TEXTURE	MEDIUM TEXTURE	MODERATELY FINE TEXTURE
DO NOT IRRIGATE	At field capacity 100	Upon squeezing no free water appears on soil but wet outline of ball is on left hand.	Same as sandy loam.	Same as sandy loam.
	75 to field capacity	Forms a weak ball, breaks easily, will not slide.	Forms a ball and is very pliable; slicks readily if relatively high in clay.	Easily ribbons out between fingers, has a slick feeling
IRRIGATE SPEC.. CROPS	50 to 75	Tends to ball under pressure but seldom will hold together	Forms a ball; somewhat plastic; will sometimes slick slightly with pressure	Forms a ball, will ribbon out between thumb and forefinger
IRRIGATE	25 to 50	Still appears to be dry, will not form ball with pressure.*	Somewhat crumbly but will hold together from pressure	Somewhat pliable, will ball under pressure
	0 to 25	Dry, loose, single-grained, flows through fingers.	Powdery, dry, sometimes slightly crusted but easily breaks down into powdery condition.	Hard, baked, cracked; sometimes has loose crumbs on surface.

* Ball is formed by squeezing a handful of soil firmly.